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# A REVIEW OF THE MULLIDÆ, SURMULLETS, OR GOATFISHES OF THE SHORES OF JAPAN

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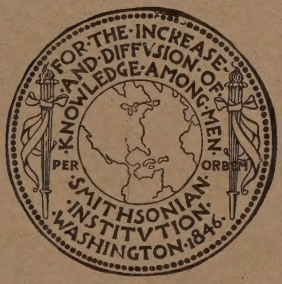


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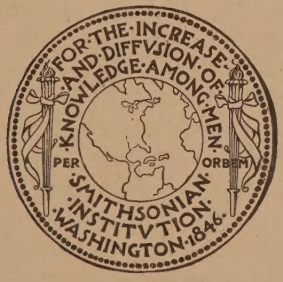


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# A REVIEW OF THE MULLIDÆ, SURMULLETS, OR GOAT-FISHES OF THE SHORES OF JAPAN.

By JOHN OTTERBEIN SNYDER,
*Assistant Professor of Zoology, Stanford University, California.*

The following account of the Mullidæ of Japan is based on material collected by Messrs. Jordan and Snyder during the summer of 1900. Collections from the Philippines, Samoa, Formosa, and Hawaii have also been available. Specimens of the species collected have been deposited in the United States National Museum and in the collections of Stanford University.

One species, *Pseudupeneus ischyrus*, is described as new.

The writer wishes to express his obligations to Dr. David Starr Jordan for indispensable aid in the preparation of this paper.

## Family MULLIDÆ.

Body elongate, slightly compressed; upper profile of head more or less parabolic; mouth small, low, subterminal; eye moderate, placed high; premaxillaries somewhat protractile, maxillaries thin, nearly as broad at base as at tip, without supplemental bone, partly hidden by the broad preorbital; teeth mostly small, variously placed; no canines, incisors, nor molars; branchiostegals 4; pseudobranchiæ present; throat with 2 long unbranched barbels attached just behind the symphysis of the lower jaw. According to Starks these barbels are suspended from the tip of a slender, nearly straight ray of bone attached to the end of the ceratohyal. Barbels, apparently similar, appear also in the *Polymixdiidæ*, but in that family the structures are, according to the same investigator, wholly different in character. Preopercle entire or slightly serrate; opercle unarmed or with a single spine. Body covered with large scales which are usually slightly ctenoid; head with large scales; lateral line continuous, the pores often branched. Dorsal fins 2, remote from each other, both short, the first of 6 or 8 rather high spines which are depressible in a groove; anal short, similar to the soft dorsal; ventrals thoracic I, 5. Air-bladder usually present, simple. Vertebræ 9+14. Stomach siphonal.

Natives of tropical seas, some species extending northward. Many of the species are highly valued as food.

The Japanese species are known as "Benisashi" (red-smear), or as "Higoi" (fire carp), or "Umihigoi" (sea red carp).

KEY TO GENERA.

*a.* Vomer and palatines without teeth.
*b.* Teeth of jaws rather strong, in one or two series ..... *Pseudupeneus*, 1
*bb.* Teeth of jaws small, subequal, in several series or in villiform bands ..... *Mulloides*, 2
*aa.* Vomer and palatines with teeth; teeth of jaws small, mostly in villiform bands ..... *Upeneus*, 3

## I. PSEUDUPENEUS Bleeker.

*Upeneus*[a] CUVIER, Règne Animal, 2d ed., 1829, II, p. 157, in part (*vittatus; russellii; bifasciatus; trifasciatus*); (restricted by Bleeker to *bifasciatus*).

*Hypeneus* AGASSIZ, Nom. Zoöl., Index Universalis, 1846, p. 190 (amended orthography).

*Pseudupeneus* BLEEKER, Poiss. Côte de Guinée, 1862, p. 56 (*prayensis*); (teeth biserial above, uniserial below).

*Parupeneus* BLEEKER, Notice sur le *Parupeneus bifasciatus* de l'Ile la Réunion, 1867, p. 345 (*bifasciatus*); (teeth uniserial, conic, in both jaws).

*Mullhypeneus* POEY, Synopsis, 1868, p. 307 (*maculatus*); (teeth partly biserial above, uniserial below).

*Brachymullus* BLEEKER, Archiv Neerl., XI, 1875, p. 333 (*tetraspilus*); (teeth in both jaws, biserial in front).

Eye large, high, posterior; opercle short, deep, with a posterior spine; jaws with one or two series of rather strong, unequal teeth; no teeth on vomer or palatines; barbels nearly as long as head; head and body with very large, somewhat ctenoid scales; lateral line continuous, its tubes branched on each scale; first dorsal with 8 spines; caudal forked. Species numerous in the tropical seas.

All the Japanese species belong to the section, *Parupeneus*, having the teeth strictly uniserial in both jaws.

(ψευδής, false; *upeneus*.)

KEY TO SPECIES.

*a.* Gillrakers numerous, about 6 + 23 on first arch; caudal peduncle with a dusky saddle; scales 30.
*b.* Soft dorsal and anal with posterior rays produced or filamentous; body with three dark crossbands ..... *moana*, 1
*bb.* Soft dorsal and anal without filamentous rays.

[a] The name *Upeneus* was first restricted by Bleeker to the species which, like *bifasciatus*, have the teeth in both jaws, conic and uniserial; those with teeth on jaws, vomer and palatines also, being called *Upeneoides*. But as *Upeneoides vittatus* is the first species mentioned under *Upeneus* by Cuvier, Bleeker afterwards transferred the name *Upeneus* to this group, giving the new name, *Parupeneus*, to *Upeneus bifasciatus*. *Vittatus* stands as *chef de file* or type in the arrangement of Cuvier and Valenciennes. It should therefore, in my judgment, remain the type of *Upeneus*, as in Bleeker's later papers.—JORDAN.

*c.* Side of body with a single dark stripe.....*ischyrus*, 2
*cc.* Side of body with 3 dark stripes; 2 dark spots behind eye.....*spilurus*, 3
*aa.* Gillrakers comparatively few, about 6+17; caudal peduncle without dusky saddle; scales 30.
*d.* Caudal peduncle with a round, black spot.
*e.* Spinous dorsal high, reaching beyond origin of soft dorsal when depressed; sides with a dusky stripe; scales bordered with black.....*barberinus*, 4
*ee.* Spinous dorsal low, not nearly reaching base of soft dorsal when depressed; no dusky laterial stripe; scales plain; a yellowish spot on laterial line between dorsal fins.....*indicus*, 5
*dd.* Caudal peduncle without black spot; each scale with a dark spot.
*f.* Sides with a golden lateral stripe; a brownish spot behind eye and another above axil.....*chrysopleuron*, 6
*ff.* Sides without lateral stripe; a black spot below lateral line under spinous dorsal; cheeks and snout with bluish stripes.....*pleurospilos*, 7

### 1. PSEUDUPENEUS MOANA Jordan and Seale.

*Upeneus trifasciatus* Günther, Fische d. Südsee, I, 1873, p. 59, pl. xliv, fig. B. U. C. (Vavau, Samoa, Amboina; not of Lacépède).—Ishikawa and Matsuura, Prelim. Cat., 1897, p. 54 (Okinawa).

*Pseudupeneus multifasciatus* Bleeker, Revis. Mull., 1874, p. 20, pl. iv, fig. 4 (East Indies).

*Upeneus multifasciatus* Seale, Occasional Papers, Bishop Mus., I, No. 3, p. 71, 1903 (Guam; not of Quoy and Gaimard).

*Pseudupeneus moana* Jordan and Snyder, Proc. U. S. Nat. Mus., XXIX, 1905, p. 534 (Tahiti).—Jordan and Seale, Bull. Bureau of Fisheries, XXV, p. 274, 1905 (1906), (Samoa).

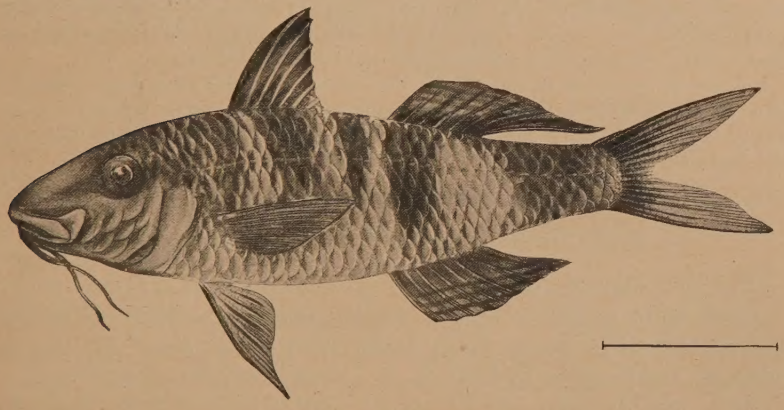

Fig. 1.—Pseudupeneus moana.

*Habitat.*—South seas north to Riu Kiu islands.

Head 3 in length to base of caudal; depth 3½; depth caudal peduncle 8½; eye 6 in head; width interorbital space 3⅔; length snout 1⅔; maxillary 2½; D. VIII–9; A. 7; scales in lateral series 30.

Snout elongate, anterior profile concave, interorbital space very convex, jaws equal. Maxillary, except small posterior portion, concealed beneath preorbital and wide upper lip. Teeth rather large, blunt, widely spaced; in a single series on both jaws, none on palatines and

vomer. Pseudobranchiæ large; gillrakers 7+28, long and slender. Peritoneum silvery. Barbels extending posteriorly to a point below tip of opercular spine. Scales weakly ctenoid; head completely scaled, the scales of snout and jaws deeply embedded, usually invisible; 2 rows of scales above lateral line, 5 between lateral line and base of anal. First dorsal spine minute, the third longest, $1\frac{3}{5}$ in head. Height of soft dorsal about 3 in head; last ray elongate, reaching base of caudal. Anal equal to dorsal in height, the last ray elongate but not quite reaching base of caudal. Caudal forked, the lobes obtusely pointed, $1\frac{1}{4}$ in head. Ventrals pointed, nearly reaching vent. Pectorals, $1\frac{1}{2}$ in head.

Color in alcohol, dusky; 4 dark, saddle-shaped bars across back and extending downward below lateral line; the first rather faint, below middle of base of spinous dorsal two faint dark shades before this; the second a little more definite, between dorsals; the third below anterior part of soft dorsal, the fourth on caudal peduncle; a light yellowish band between the last 2 dark ones; spinous dorsal dusky; soft dorsal blackish anteriorly and posteriorly, the lighter parts with narrow dusky stripes; anal with narrow dusky stripes, those nearer edge of fin more prominent; anterior portions of ventrals dusky.

Described from a Samoan specimen 220 mm. long.

Color in life dusky, purplish red, with 4 darker crossbands; dorsals clouded with dusky; second dorsal with blue and yellow streaks at tip; caudal dark brown, edged with black above and below; anal pale violet, with 4 violet and 4 light yellow streaks; ventral red, with a purple black edge; pectoral bright golden orange.

This species, common in the East Indies and in the South Seas, seems never to have received a distinctive name. The name *trifasciatus* certainly belongs to *Pseudupeneus bifasciatus*, while that of *multifasciatus* was given to the common moana of the Hawaiian Islands.—JORDAN.

(*moana*, Samoan name, meaning the sea.)

2. **PSEUDUPENEUS ISCHYRUS** Snyder, new species.

*Habitat.*—Bay of Tokyo.

Head $3\frac{1}{5}$ in length to base of caudal; depth $2\frac{9}{10}$; depth of caudal peduncle $7\frac{2}{5}$; eye $4\frac{1}{2}$ in head; width interorbital space $3\frac{2}{5}$; length snout 2; maxillary 3; D. VIII–9; A. 7; scales in lateral line 28.

Body notably deep, dorsal outline gently sloping from snout to spinous dorsal. Eye located nearer border of opercle than tip of snout, a distance equal to half the diameter of orbit. Interorbital area very convex. Snout pointed; jaws equal; lips broad; maxillary concealed for the greater part of its length by upper lip and overhanging preorbital, not nearly reaching a vertical through anterior edge of orbit. Teeth on jaws a single row of small, widely spaced, blunt canines; palatines and vomer without teeth. Pseudobranchiæ large; gillrakers 6+23, long, slender, flattened toward their bases. Peritoneum light. Barbels extending posteriorly to edge of preopercle.

Preopercle smooth; opercle with a small, flat spine at angle. Head completely scaled, the scales of snout, maxillary, and chin deeply embedded; scales of body weakly ctenoid; 2 rows above lateral line, 6 between lateral line and insertion of anal; dorsal and anal naked; small scales on caudal. Pores of lateral line with 5 or 6 branches. First dorsal spine minute and closely adnate to second; the third longest, $1\frac{3}{5}$ in head. Height of soft dorsal equal to that of anal, $2\frac{1}{10}$ in head. Caudal deeply forked, the lobes pointed, about equal in length to head. Pectorals and ventrals extending an equal distance posteriorly, their length $1\frac{1}{3}$ in head.

Color in spirits dark brownish; an indefinitely defined dark stripe extending from snout through eye, along lateral line at least to end of spinous dorsal; a narrow light stripe below the dark one; a dusky saddle across caudal peduncle.

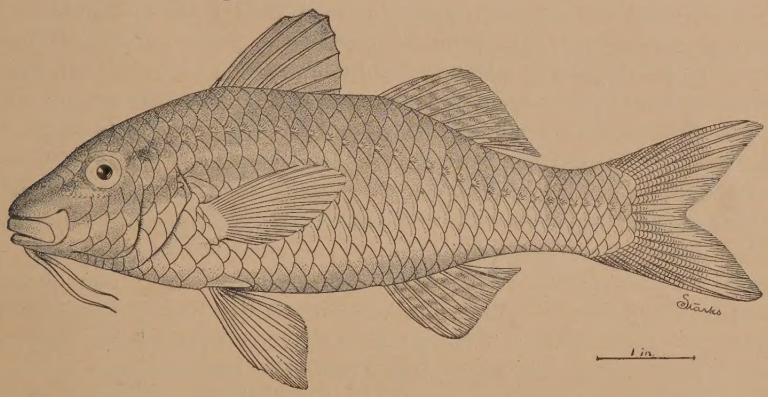


FIG. 2.—PSEUDUPENEUS ISCHYRUS.

The species is represented by the type only, a poorly preserved specimen from Tokyo, No. 9790, Stanford University collection. Length, 195 mm.

This species is closely related to *Pseudupeneus signatus* (Günther). It seems to differ in having a much deeper caudal peduncle and a smaller eye, distinguishing characters which appear at once when the specimen is compared with one of *P. signatus* from Lord Howe Island. (*ἰσχυρός*, robust.)

### 3. PSEUDUPENEUS SPILURUS (Bleeker).

*Upeneus spilurus* BLEEKER, Fauna Ichth. Jap., 1854, p. 395 (Nagasaki); Verh. Bat. Gen., XXVI, 1854, p. 68, pl. II, fig. 2 (Japan).—JORDAN and SNYDER, Prelim. Check List, 1901, p. 84.—GÜNTHER, Cat. Fishes, I, 1859, p. 406 (copied).

*Habitat.*—Southern Japan.

Head $3\frac{1}{5}$ in length to base of caudal; depth 3; depth of caudal peduncle 8; eye $5\frac{1}{2}$ in head; width interorbital space 3; length snout 2; maxillary $2\frac{3}{5}$; D. VIII–9; A. 7; scales in lateral line 29.

Body deep, the dorsal contour strongly arched; snout long, pointed, its dorsal outline concave. Interorbital space very convex, occasionally somewhat flattened. Lower jaw slightly shorter than upper; lips very broad, the upper partly covering anterior half of maxillary. Maxillary fleshy, the greater part of upper edge covered by preorbital. Barbels extending to a vertical midway between edges of opercle and preopercle. No teeth on vomer and palatines; a single row of widely spaced, blunt canines on jaws. Pseudobranchiæ large. Gillrakers 6+23, slender, the longest equal to diameter of eye. Air bladder large. Peritoneum silvery. Preopercle smooth; opercle with a large, flat spine at upper angle. Head completely scaled, the scales of snout, maxillary, and chin deeply embedded, sometimes not visible; scales weakly ctenoid; 2 rows above lateral line, 6 between lateral line and origin of anal; small scales on caudal; soft dorsal and anal naked. Pores of lateral line apparently single or with 3 or 4 branches on anterior scales; with many minute branches on posterior ones. First dorsal spine very short and closely adnate to second; third and fourth spines longest, $1\frac{3}{5}$ in head, reaching beyond tips of other spines in closed fin. Height of longest, (third or fourth) dorsal ray $1\frac{1}{2}$ in head; anal slightly lower than soft dorsal; caudal deeply cleft, the lobes pointed, $1\frac{1}{3}$ in head; pectorals and ventrals pointed, about $1\frac{2}{3}$ in head.

Color in life bright carmine red, with 3 curved stripes, olive in color with a brassy sheen, extending from tip of snout to below end of soft dorsal fin, the median stripe passing through eye and along lateral line; caudal peduncle with a blackish saddle, the lower portions of which are often darker, forming on each side a round black spot; 2 round dusky spots behind eye; fins pink, the pectorals and spinous dorsal darker than others; ventrals with indistinct basal and subterminal dark bands. In spirits the bright colors entirely disappear, leaving 3 indistinct, dusky lateral stripes on the sides, and a dark saddle across the caudal peduncle. Some examples are less brightly colored. Length about 300 mm. Southern Japan, rare. Our specimens are from Wakanoura and Nagasaki.

(*σπίλος*, spot; *οὐρά*, tail.)

#### 4. PSEUDUPENEUS BARBERINUS (Lacépède.)

*Mullus barberinus* LACÉPÈDE, Hist. Nat. Poiss., III, 1802, p. 406, pl. XIII, fig. 3 (Straits of Bouton).

*Upeneus barberinus* CUVIER and VALENCIENNES, Hist. Nat. Poiss., III, 1829, p. 642 (copied).—RÜPPELL, N. W. Fische, 1837, p. 101 (Red Sea).—GÜNTHER, Cat. Fishes, I, 1859, p. 405 (Moluccas, Amboyna, India); Fische d. Sudsee, I, 1873, p. 57, pl. XLII (Palau, Paumoto, Tahiti, Samoa, Kingsmill, Solomon Island).—KNER, Novara, Fische, 1865, p. 70.—KLUNZINGER, Fische d. roth. Meer, 1870, p. 745 (Red Sea).—DAY, Fishes India, 1878, p. 124.—JORDAN and SNYDER, Prelim. Check List, 1901, p. 84.

*Parupeneus barberinus* BLEEKER, Ternate, p. 234 (East Indies); Revis. Mull., 1874, p. 25.

*Pseudupeneus barberinus* JORDAN and SEALE, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 782 (Negros); Fishes Luzon and Panay, Bull. Bureau of Fisheries, XXVI, p 25, 1906 (1907), (Iloilo); Fishes Samoa, Bull. Bureau of Fisheries, XXV, p. 276, 1905 (1906), (Apia).

*Habitat.*—East Indies and South Seas, north to Riu Kiu Islands.

Head 3 in length to base of caudal; depth $3\frac{1}{5}$; depth of caudal peduncle $8\frac{1}{2}$; eye $6\frac{1}{2}$ in head; width interorbital space $4\frac{5}{8}$; length snout $1\frac{3}{4}$; maxillary $3\frac{1}{8}$; D. VIII–9; A. 7; scales in lateral line 30.

Snout notably long, its upper contour concave; interorbital space convex; eye nearer edge of opercle than tip of snout, a distance equal to twice the vertical diameter of orbit. Jaws equal; upper edge of maxillary sheathed by preorbital; posterior edge convex. Teeth rather large, widely spaced, in a single series on jaws; none on vomer or palatines. Pseudobranchiæ large; gillrakers 7+17; long, slender, and sharply pointed. Peritoneum dusky. Barbels extending to edge of preopercle. Opercular spine flat and blunt; preopercle smooth. Scales ctenoid; those of snout, maxillary, and lower jaw deeply embedded; 3 rows above lateral line, 6 between lateral line and base of anal; pores of lateral line with 10 or 12 branches. Spinous dorsal high, reaching to base of third dorsal ray when depressed; first spine very short; the third longest, $1\frac{1}{3}$ in head; eighth, $6\frac{2}{3}$ in head. Soft dorsal and anal equal in height, $2\frac{2}{3}$ in head. Caudal lobes acute, $1\frac{1}{6}$ in head; pectoral, $1\frac{3}{5}$; ventral, $1\frac{1}{2}$.

Color in spirits brownish, each scale with a dark edge; a dark stripe extending from upper edge of opercle backward to end of soft dorsal; a round, blackish spot near base of caudal.

This species is abundant in the East Indies and in the South Seas north to the Riu Kiu Islands.

According to Doctor Jordan, the life colors are as follows:

Reddish gray with bluish and yellowish streaks on head, the scales edged with bronze; a blackish brown stripe from snout through eye to last dorsal rays; a large, dark brown spot at base of caudal; barbels white. Dorsal reddish, edged with brown in front; second dorsal and anal with obscure, yellowish cross-streaks; caudal reddish, the rays yellowish; ventrals and pectorals pale, tinged with yellowish.

This species is abundant in the East Indies and in the South Seas north to the Riu Kiu Islands. It is here described from Samoan specimens.

(Name unexplained; perhaps for Barberini.)

### 5. PSEUDUPENEUS INDICUS (Shaw).

*Mullus indicus* SHAW, Genl. Zool., IV, 1803, Pt. 2, p. 416 (Vizagapatam; after *Rahtee goolivinda* of Russell).

*Upeneus indicus* GÜNTHER, Cat. Fishes, I, 1859, p. 406 (China); Fische d. Sudsee, I, 1873, p. 57 (Samoa).—DAY, Fishes Malabar, 1865, p. 28 (Malabar); Fishes India, 1878, p. 126, pl. xxxi, fig. 4 (India). ISHIKAWA and MATSUURA, Prelim. Cat., 1897, p. 54 (Riu Kiu).—JORDAN and SNYDER, Prelim. Check List,

1901, p. 84 (Nagasaki).—JORDAN and EVERMANN, Proc. U. S. Nat. Mus., XXV, 1902, p. 334 (Keerun, Giran).

*Pseudupeneus indicus* JORDAN and SEALE, Fishes Luzon and Panay, Bull. Bureau of Fisheries, XXVI, p. 25, 1906 (1907), (Iloilo); Fishes Samoa, Bull. Bureau of Fisheries, XXV, p. 276, 1905 (1906), (Apia).

*Parupeneus indicus* BLEEKER, Bouro, p. 148; Revis. Mull., 1874, p. 27.

*Upeneus russellii* CUVIER and VALENCIENNES, Hist. Nat. Poiss., III, 1829, p. 465, (after Russell).—RICHARDSON, Ichth. China, 1846, p. 220 (Canton).—BLEEKER, Percoiden, 1849, p. 62 (East Indies).

*Upeneus waigiensis* CUVIER and VALENCIENNES, Hist. Nat. Poiss., III, 1829, p. 446 (Waigiu).

*Upeneus malabaricus* CUVIER and VALENCIENNES, Hist. Nat. Poiss., III, 1829, p. 467 (Malabar).—GÜNTHER, Cat. Fishes, I, 1859, p. 407 (Philippines); Fische d. Sudsee, I, 1873, p. 58, pl. XLV, fig. B (Formosa, Philippines, Zanzibar, Savaii, Tonga).

*Mullus malabaricus* PLAYFAIR, Fish. Zanz., p. 41 (Zanzibar).

*Upeneus griseofrenatus* KNER, Sitz. Wien. Akad., 1868, XVIII, p. 305, pl. III, fig. 7 (Fiji).

*Habitat.*—South Seas and India, north to Riu Kiu Islands.

Head $3\frac{1}{4}$ in length; depth $3\frac{1}{5}$; depth caudal peduncle $7\frac{1}{5}$; eye $4\frac{1}{2}$ in head; width interorbital space $3\frac{4}{5}$; length snout $2\frac{1}{10}$; maxillary $3\frac{1}{10}$; D. VIII–9; A. 7; scales in lateral line 30.

Interorbital space convex; snout short; eye located nearer border of opercle than tip of snout, a distance equal to $\frac{2}{3}$ its diameter. Edge of maxillary covered by preorbital sheath; jaws equal. Teeth of jaws in a single row, widely spaced, rather blunt; vomer and palatines smooth. Pseudobranchiæ large; gillrakers, 6+17, rather long and slender. Peritoneum dusky. Barbels extending a little beyond edge of preopercle. Opercular spine flat and sharp. Scales ctenoid, those of snout, maxillary, and jaw not concealed beneath thick skin; 3 rows above lateral line, 5 between lateral line and base of anal fin. Pores of lateral line with 5 or 6 branches. First dorsal spine minute, the third longest, $1\frac{2}{3}$ in head; depressed fin not nearly reaching base of soft dorsal. Soft dorsal and anal of equal height, $2\frac{1}{6}$ in head. Caudal equal in length to head. Pectoral, $1\frac{1}{3}$ in head; ventral, $1\frac{1}{4}$.

Alcoholic specimens have a light spot on lateral line between the dorsal fins, and a black spot on upper middle portion of caudal peduncle.

The species is here described from a Formosan specimen about 155 mm. long. Doctor Jordan thus describes the colors of a living example from Apia:

Olive green, each scale with a darker edge; a large, oblong, golden-yellow blotch under soft dorsal; a large, black blotch before base of caudal; cheeks olive, with blue streaks. Dorsals olive; second dorsal faintly barred with brassy; anal pinkish, similarly barred; ventral and pectoral pinkish; caudal pale, yellowish olive, the outer rays pink; barbels pinkish.

The species is abundant in the Indies, ranging northward to the Riu Kiu Islands.

(*indicus*, Indian.)

### 6. PSEUDUPENEUS CHRYSOPLEURON (Temminck and Schlegel).

UMIHIGOI[a] (SEA FIRE-CARP).

*Mullus chrysopleuron* Temminck and Schlegel, Faun. Japon. Poiss., 1845, p. 29, pl. xii, fig. 1 (Nagasaki).—Bleeker, Verh. Bat. Gen., XXV, p. 10 (Japan); XXVI, 1854, p. 70 (Japan).

*Upeneus chrysopleuron* Günther, Cat. Fishes, I, 1859, p. 410 (China).—Jordan and Snyder, Prelim. Check List, 1901, p. 84.

*Upeneus biaculeatus* (Gray) Richardson, Ich., China, 1846, p. 219 (Canton).

(?) *Upeneus dubius* Temminck and Schlegel, Faun. Japon. Poiss., 1845, p. 30, pl. xi, fig. 3 (Nagasaki).—Günther, Cat. Fishes, I, 1859, p. 411 (copied).

*Habitat.*—Coasts of southern Japan and China.

Head $3\frac{1}{5}$ in length to base of caudal; depth $3\frac{1}{5}$; depth caudal peduncle $8\frac{1}{4}$; eye $4\frac{2}{3}$ in head; width interorbital space $3\frac{1}{2}$; snout $1\frac{9}{10}$; maxillary $2\frac{2}{4}$; D. VIII–9; A. 7; scales in lateral line 28.

Dorsal profile of head and body steep, the ventral outline almost straight. Snout rather blunt; jaws equal; maxillary not nearly reaching vertical through anterior edge of orbit, the greater part of its edge slipping under preorbital; lips broad. Eye located nearer edge of opercle than tip of snout, a distance equal to diameter of orbit. Teeth on jaws a single row of widely spaced, sharp canines; none on palatines or vomer. Pseudobranchiæ large; gillrakers 4 + 18, long and very slender; those on upper arch preceded by 4 or 5 minute knobs. Peritoneum silvery. Barbels not quite reaching a point below border of opercle. Preopercle entire. Opercle with a small, flat sharp spine at angle. Head completely scaled, the scales of snout, maxillary, and chin deeply embedded; scales of body weakly ctenoid; 2 rows above lateral line, 5 between lateral line and origin of anal; caudal with small scales, the soft orsal and anal apparently naked. Pores of lateral line with 4 or 5 branches. First dorsal spine minute, the third longest, $1\frac{2}{4}$ in head. Height of soft dorsal and anal $1\frac{9}{10}$ in head. Caudal lobes pointed, $1\frac{1}{5}$ in head. Pectorals and ventrals pointed, $1\frac{2}{5}$ in head.

Color in life, bright red, a bright-golden stripe extending from eye to base of caudals; fins all red; barbels pale yellow. In alcoholic specimens the lateral stripe is visible, a dusky vertical line or spot appears on each scale above the stripe, and there is a brownish spot behind eye and another above axil.

Specimens 180 mm. long were collected at Wakanoura and Tokyo. The species is not very common, but being of large size is valued as food.

Individuals of this species were observed slowly swimming near the bottom of a tank, the conspicuous yellow barbels extended forward and constantly moved about as if they were organs of touch.

(*χρυσός*, gold: *πλεύρον*, side.)

[a] *Umi*, sea; *hi*, fiery-red; *koi*, carp.

### 7. PSEUDUPENEUS PLEUROSPILOS (Bleeker).

*Upeneus pleurospilos* BLEEKER, Natur. Tyds. Nederl. Ind., IV, 1853, p. 110 (Amboyna); Verh. Bat. Gen., XXVI, 1854, p. 69 (Japan).—GÜNTHER, Cat. Fishes, I, 1859, p. 407 (copied).

*Habitat.*—East Indies, north to Nagasaki.

D. VIII–9; A. 8; scales lateral line 30.

The height of the body is nearly equal to the length of the head, $4\frac{1}{2}$ in the total. The barbels reach to the posterior margin of the operculum. Spinous dorsal much lower than the body. Rose colored; each scale of the back and of the sides with a central reddish-violet spot; a black spot below the lateral line, corresponding to the posterior part of the spinous dorsal; cheeks and snout with bluish stripes; the second dorsal with two blue longitudinal bands; the caudal, anal, and ventral fins with yellow bands.—(Günther after Bleeker.)

This species was not seen by the writer.

(*πλεύρον*, side: *σπίλος*, spot.)

## 2. MULLOIDES Bleeker.

*Mulloides* BLEEKER, Percoiden, Sept., 1848, in Verh. Bat. Gen., XXII, 1849, (*flavolineatus*).

In this genue the teeth in both jaws are in narrow villiform bands. There are none on the vomer or palatines. Species numerous, chiefly in the Pacific Ocean.

(*mullus*, the surmullet: *εἶδος*, likeness.)

### 8. MULLOIDES JAPONICUS (Houttuyn).

*Mullus japonicus* HOUTTUYN, Mém. Harl., XX, 1782, p. 334 (Nagasaki).

*Upeneus japonicus* CUVIER and VALENCIENNES, Hist. Nat. Poiss., III, 1829, p. 460 (Japan).

*Mulloides japonicus* GÜNTHER, Cat. Fishes, I, 1859, p. 404 (copied).

*Habitat.*—Coasts of southern Japan.

Head $3\frac{1}{2}$ in length; depth $4\frac{2}{5}$; depth of caudal peduncle 11; eye $3\frac{1}{2}$ in head; width interorbital space $3\frac{1}{2}$; length snout $2\frac{3}{5}$; maxillary $3\frac{1}{3}$; D. VIII–9; A. 7; scales lateral line 37.

Body slender, the snout pointed. Eye slightly nearer tip of snout than border of opercle. Interorbital space not strongly convex. Jaws equal; maxillary not quite reaching vertical through anterior margin of orbit; evenly rounded posteriorly; about two-thirds of its upper edge concealed by preorbital. Teeth minute; in narrow bands on jaws; those in upper jaw in but 2 or 3 rows; vomer and palatines without teeth. Pseudobranchiæ large; gillrakers 7 + 23, long and slender. Peritoneum dusky. Barbels extending to edge of preopercle. Angle of opercle with a small, flat spine; preopercle entire. Head, including snout, maxillary, and chin, scaled; scales of body weakly ctenoid; 3 rows above lateral line, 5 rows between lateral line and base of anal; caudal with minute scales; dorsal and anal naked. Tubes of lateral

line with 3 or 4 branches. Dorsal spines very slender; the first longest, $1\frac{1}{2}$ in head; apparently not preceded by a minute, embedded spine; soft dorsal and anal of equal height, the longest ray $2\frac{1}{5}$ in head. Lobes of caudal acutely pointed, about equal to length of head. Ventrals slightly longer than pectorals, $1\frac{2}{3}$ in head.

Color in spirits brownish above, silvery below.

Two specimens, 140 mm. long, from Misaki.

This species is certainly the *japonicus* of Cuvier and Valenciennes, and it is probably also that of Houttuyn, although Houttuyn says scarcely anything about the species, and part of that is untrue.[a]

(*japonicus*, Japanese.)

## 3. UPENEUS Cuvier.

*Upeneus* Cuvier, Règne Animal, 2d ed., 1829, p. 157 (*vittatus*, etc.).

*Upeneus* Section I, Cuvier and Valenciennes, Hist. Nat. Poiss., III, 1829, p. 448 (*vittatus*).

*Upeneoides* Bleeker, Percoiden, 1849, p. 63 (*vittatus*).

Teeth in villiform bands on jaws, vomer, and palatines. Pacific Ocean.

(*upeneus*, a Latin name of some fish from ὑπήνη, upper lip.)

KEY TO SPECIES.

*a*. Dorsal spines VII, the first long and slender; caudal lobes barred in life; scales 36 ..... *bensasi*, 9

*aa*. Dorsal spines VIII, the first very short.

*b*. Scales small, about 36 in lateral line; anal rays 8; gillrakers about 7+18 *sulphureus*, 10

*bb*. Scales larger, about 30 in lateral line; anal ray 7; gillrakers about 2+12.

*c*. Body with brown lateral stripe; spinous dorsal with a black spot .. *tragula*, 11

*cc*. Body plain; dorsal fins narrowly edged with dusky ..... *subvittatus*, 12

### 9. UPENEUS BENSASI (Temminck and Schlegel).

BENISASHI (RED-SMEAR).

*Mullus bensasi* Temminck and Schlegel, Faun. Japan. Poiss., 1845, p. 30, pl. XI, fig. 2 (Nagasaki).

*Upeneoides bensasi* Bleeker, Verh. Bat. Gen., XXVI, 1854, p. 71 (Nagasaki).—Günther, Cat. Fishes, I, 1859, p. 399 (copied).— (?) Day, Fishes India, 1878, p. 121, pl. XXX, fig. 5 (Madras, Coromandel).—Ishikawa and Matsuura, Prelim. Cat., 1897, p. 54 (Tokyo).

*Upeneoides japonicus* Steindachner and Döderlein, Fisch. Jap., II, 1883, p. 22 (Oshima, Kochi, Tokyo, Tango).—Jordan and Snyder, Proc. U. S. Nat. Mus., XXIII, 1900, p. 358 (Tokyo); Prelim. Check List, 1901, p. 83 (Yokohama). (Not *Mullus japonicus* Houttuyn.)

*Upeneoides tokisensis* Steindachner and Döderlein, Fisch. Jap., II, 1883, p. 22 (Tokyo).

[a] D. VII-9. Caudal forked; mouth toothless; color more yellow than red; length 6 inches.

*Habitat.*—Coasts of Japan, southward.

Head 3⅓ in length to base of caudal; depth 4; depth caudal peduncle 10; eye 4 in head; width interorbital space 3½; length snout 2⅔; maxillary 2⅔; D. VII–9; A. 7; scales in lateral series 30.

Eye located midway between tip of snout and opercle, its upper edge almost on a line with dorsal contour of head. Interorbital space somewhat convex, the width equal to or greater than diameter of eye, the proportions differing with age. Lower jaw included; maxillary equal in length to snout, extending to a point below anterior margin of eye, its upper edge, except at tip, covered by preorbital. Teeth villiform, in bands on jaws, vomer, and palatines; premaxillary band broadening posteriorly, then narrowing and growing sharply pointed at the ends; mandibular band gradually narrowing from before backward. Pseudobranchiæ large; gillrakers, 4+13, slender, the longest about equal to diameter of pupil; those on upper arch preceded by 4 small knobs. Air bladder present. Cæca 15. Peritoneum, black.

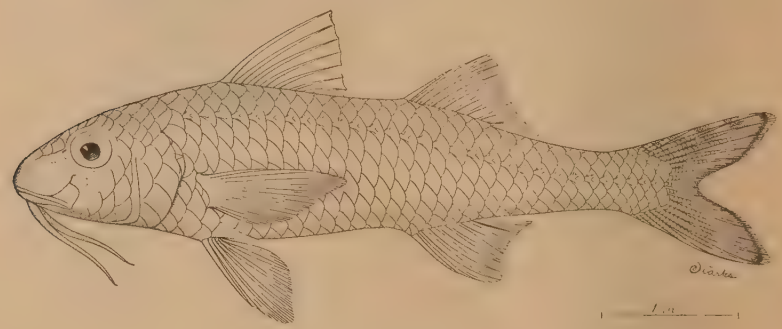

FIG. 3.—UPENEUS BENSASI.

Barbels extending posteriorly almost to end of opercle. Edge of preopercle, smooth; opercle with a weak, somewhat rounded spine at its angle. Scales, weakly ctenoid; head, including snout, maxillary, chin, and throat, scaled; soft dorsal, anal, and caudal with small scales; 2 rows between lateral line and spinous dorsal; 6 rows between lateral line and anal. Tubes of lateral line with 4 or 5 branches. First dorsal spine longest, in most examples reaching beyond tips of others when fin is depressed, 1⅓ in head, apparently not preceded by a minute, embedded spine; membrane of fin extending to tips of spines. First dorsal ray simple; the second longest, 1¾ in head. Anal inserted below second dorsal ray, its height about 2½ in head. Pectorals and ventrals pointed, extending an equal distance posteriorly; pectoral 1¼ in head; ventral 1½. Caudal deeply forked 1⅓ in head.

Color in life rosy, with faint yellowish lines; fins barred with orange red; dorsals and upper lobe of caudal with oblique, reddish-brown bands, the interspaces pearly, the lower lobe of caudal mostly

brick red; lower fins pale. In spirits all traces of the life color disappear, the specimens becoming brownish above and silvery below. An occasional example has the caudal narrowly tipped with dusky, and the upper lobe indistinctly barred. Length about 170 mm.

Described from specimens obtained in the market at Wakanoura, where it was the smallest and commonest representative of the family. Taken also at Nagasaki and Tokyo. In the specimen figured, the dorsal markings are faded.

(Japanese, *beni*, red; *sashi*, a smear or daub.)

### 10. UPENEUS SULPHUREUS Cuvier and Valenciennes.

*Upeneus sulphureus* CUVIER and VALENCIENNES, Hist. Nat. Poiss., III, 1829, p. 450 (Antjer).—BLEEKER, Revis. Mull., 1874, p. 4 (Batavia).—JORDAN and SEALE, Fishes Philippines MS. (Cavite).

*Upeneus bivittatus* CUVIER and VALENCIENNES, Hist. Nat. Poiss., VII, 1831 (Coromandel).

*Upeneoides sulphureus* BLEEKER, Act. Soc. Nederl., II, Amboina, 1857, p. 45 (Amboyna).—GÜNTHER, Cat. Fishes, I, 1859, p. 398 (Red Sea, Amboyna, China, New Hebrides).—KNER, Novara Fische, 1865, p. 67.—DAY, Fishes India, 1878, p. 120, pl. XXX, fig. 3 (India).—STEINDACHNER and DÖDERLEIN, Fisch. Jap., II, 1883, p. 23 (Nagasaki).—JORDAN and SNYDER, Prelim. Check List, 1901, p. 84.

*Upeneoides fasciolatus* DAY, Proc. Zool. Soc., 1868, p. 151 (India.)

*Upeneus pinnifasciatus* STEINDACHNER, Ich. Not., X, 1870, p. 2 (Nagasaki).

*Habitat.*—East Indies, north to Nagasaki.

Head $3\frac{2}{5}$ in length to base of caudal; depth $3\frac{2}{5}$; depth caudal peduncle $8\frac{3}{4}$; eye $3\frac{3}{4}$ in head; width interorbital space $3\frac{3}{4}$; length snout $2\frac{1}{2}$; maxillary $2\frac{2}{5}$; D. VIII–9; A, 8; scales in lateral line 36.

Snout rather short; anterior profile steep; eye located high in head, midway between tip of snout and border of opercle; interorbital space only slightly convex. Lower jaw shorter than upper; maxillary extending to below center of pupil, broad and rounded posteriorly, the upper edge slipping under preorbital. Teeth in villiform bands on jaws, vomer, and palatines. Pseudobranchiæ large; gillrakers, 7+18, long and very slender. Barbels extending to a vertical passing midway between edge of preopercle and opercle. Preopercle smooth; opercle with but a trace of a spine at angle; scales ctenoid; head completely scaled; 3 rows between lateral line and dorsal, 6 between lateral line and anal; dorsal, anal, and caudal with minute scales; pores of lateral line with 4 to 6 branches. First dorsal spine minute, the second longest, $1\frac{1}{3}$ in head; dorsal and anal of equal height, 2 in head; caudal $1\frac{1}{3}$; pectoral, $1\frac{1}{4}$; ventral, $1\frac{2}{3}$.

Color in spirits, brownish above, yellowish below; upper parts with traces of narrow, yellow stripes; spinous dorsal with 3 horizontal stripes, the upper one terminal and dense black; soft dorsal and caudal edged with dusky.

Described from a specimen measuring 130 mm., from Samoa.

It was not seen by us in Japan, but it is recorded by Steindachner from Nagasaki.

(*sulphureus*, sulphur-yellow.)

### 11. UPENEUS TRAGULA Richardson.

*Upeneus tragula* Richardson, Ichth. China, 1846, p. 220 (Canton).—Jordan and Seale, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 782 (Negros).—Jordan and Seale, Fishes Philippines MS. (Manila, Cavite, Iloilo, Panay).

*Upeneoides tragula* Günther, Cat. Fishes, I, 1859, p. 398 (Amboyna, Philippines, Canton).—Kner, Novara, Fische, 1837, p. 66.—Day, Fishes India, 1878, p. 121, pl. xxx, fig. 4 (India, Andaman Is.).—Steindachner and Döderlein, Fische Jap., II, 1883, p. 22 (Kagoshima).—Jordan and Evermann, Bull. U. S. Nat. Mus., XXV, 1902, p. 335 (Keerun, Giran, Formosa, Hokoto).

*Mullus tragula* Playfair, Fish. Zanzibar, p. 40 (Zanzibar).

*Upeneoides variegatus* Bleeker, Percoiden, 1849, p. 64; Act. Soc. Nederl, II, Amboina, 1857, p. 48 (Amboyna).

*Upeneoides kiusiuana* Steindachner and Döderlein, Fisch. Jap., II, 1883, p. 22 (Kagoshima).

*Habitat.*—East Indies, north to southern Japan.

Head 3½ in length to base of caudal; depth 4; depth caudal peduncle 9; eye 4 in head; width interorbital space 4; length snout 2⅔; maxillary, 2½; D. VIII–9; A. 7; scales lateral line 30.

Snout rather long and pointed; the anterior profile not steep, but gently sloping from snout to dorsal fin; interorbital space flat or slightly concave. Eye located high in head, midway between tip of snout and edge of opercle. Lower jaw somewhat shorter than the upper; maxillary extending to anterior edge of pupil, rounded posteriorly the entire upper edge sheathed by preorbital. Teeth villiform; in broad bands on jaws, vomer and palatines. Pseudobranchiæ large; gillrakers, 2+12, rather long and slender, those of upper row preceded by 5 rounded knobs; the lower ones followed by 4 or 5 similar elevations. Peritoneum silvery. Cœca 11. Air-bladder large. Barbel not extending quite as far posteriorly as preopercle. Opercle with a weak, flat spine at angle. Scales ctenoid; head, including snout, maxillary and chin completely scaled; 2 rows between dorsals and lateral line, 5 between anal and lateral line. Pores of lateral line with many branches. First dorsal spine minute, the second longest, 1⅔ in head. Soft dorsal and anal of equal height, 1⅔ in head. Caudal equal in length to head. Pectorals 1½, ventrals 1⅓ in head.

Color in spirits brown above, light below; a brown stripe extending from snout, through eye along side of body to base of caudal, above which is an indistinct light stripe; dorsals clouded with dusky, a large, black, subterminal spot of irregular outline on spinous dorsal; caudal lobes with 4 or 5 oblique, dark bars, those on the lower lobe broader; pectorals, ventrals, and anal with dusky spots or bars.

Described from Formosan specimens about 230 mm. long.

This species is common in the South Seas, and it has been once recorded from Kagoshima, in Kiushu.

(*tragula*, a dart or javelin.)

### 12. UPENEUS SUBVITTATUS Temminck and Schlegel).

*Mullus subvittatus* Temminck and Schlegel, Fauna Japon. Poiss., 1845, p. 30 (Nagasaki).—Richardson, Ichth. China, 1846, p. 219 (Canton).
*Upeneoides subvittatus* Jordan and Snyder, Prelim. Check List, 1901, p. 83.

*Habitat.*—Southern Japan and China.

Head $3\frac{2}{5}$ in length to base of caudal; depth $4\frac{1}{4}$; depth of caudal peduncle $10\frac{1}{2}$; eye 6 in head; width interobital space $3\frac{1}{4}$; length snout $2\frac{1}{2}$; maxillary $2\frac{1}{3}$; D. VIII–9; A. 7; scales in lateral line 30.

The eye is situated lower, the interorbital space is more convex, the dorsal outline of head nearer horizontal, and the lower jaw longer than in *U. bensasi*. Eye midway between tip of snout and border of opercle. Jaws equal; maxillary extending to a point below anterior edge of pupil, the posterior edge broad, rounded and not sheathed by preorbital. Teeth villiform, in bands on jaws, vomer, and palatines. Pseudobranchiæ large; gillrakers 1+12, short, flat, and stout, the one on upper arch preceded by 5 broad knobs. Air-bladder large. Peritoneum silvery. Cœca apparently 5. Barbels extending posteriorly to edge of preopercle. Preopercle smooth; opercle with a broad, very flat spine at angle. Head, including snout, maxillary, throat and chin completely scaled; scales of body weakly ctenoid; 2 rows between lateral line and dorsals, 6 between lateral line and anal; soft dorsal, anal, and caudal with fine scales. Pores of lateral line with 5 or 6 branches. First dorsal spine minute, embedded; the second longest, $1\frac{3}{5}$ in head, not extending to tips of other spines when fin is depressed. Height of soft dorsal $2\frac{1}{6}$ in head, the first ray simple. Origin of anal below third or fourth dorsal ray, its height equal to that of soft dorsal. Caudal deeply notched, the lobes acutely pointed, the upper longer, $1\frac{1}{3}$ in head. Pectorals and ventrals extending an equal distance posteriorly, $1\frac{2}{3}$ in head.

Color in spirits dusky above, light below; dorsal fins edged with dusky; caudal with 6 oblique, dusky bars, those on lower lobe the more prominent. Belly probably silvery in life.

We have one specimen of this rare species measuring 175 mm. in length, from Wakanoura. It is otherwise recorded from Nagasaki and from Canton.

*U. vittatus* differs from this species in having smaller scales (35), a shorter snout, a narrow yellow stripe along side of body, and a conspicuous, broad, subterminal black band on lower lobe of caudal. Belly sulphur yellow in life.

*U. arge* of the Hawaiian Islands, a form resembling *U. subvittatus*, especially in having a barred caudal, differs in the smaller scales (40) and shorter and more rounded snout. In this species the belly is silvery.

(*subvittatus*, partly striped.)

## SUMMARY.

Family MULLIDÆ.

*1. Pseudupeneus* Bleeker, 1862.

1. *moana* Jordan and Seale, 1906.
2. *ischyrus* Snyder, 1906, Tokyo.
3. *spilurus* (Bleeker) 1854; Wakanoura, Nagasaki.
4. *barberinus* (Lacépède), 1802.
5. *indicus* (Shaw), 1803.
6. *chrysopleuron* (Temminck and Schlegel), 1845; Wakanoura, Tokyo.
7. *pleurospilos* (Bleeker), 1853.

*2. Mulloides* Bleeker, 1848.

8. *japonicus* (Houttuyn), 1782; Misaki.

*3. Upeneus* Cuvier, 1829.

9. *bensasi* Temminck and Schlegel, 1845; Tokyo, Wakanoura, Nagasaki.
10. *sulphureus* Cuvier and Valenciennes, 1829.
11. *tragula* Richardson, 1846.
12. *subvittatus* (Temminck and Schlegel), 1845; Wakanoura.